ABSTRACT
        In this document, a review of traditional definitions
and theories of metaphor suggests that they err in equating metaphors
with comparisons rather than merely implying comparisons. Empirical
research is then reviewed, revealing serious problems, particularly
in developmental research. These problems include inadequate theories
about the nature of metaphor, inadequate control over preexisting
knowledge, and hasty conclusions that children cannot understand
metaphors, drawn because in certain experimental conditions children
do not select metaphorical interpretations. Related research on the
comprehension of proverbs and analogies is discussed and
recommendations for future research are made. These depend on a
redefinition of metaphor and on adequate controls of preexisting
knowledge, surface structure, and meaning. The approach suggested
emphasizes the context-dependent nature of metaphors. Finally, it is
argued that, even if metaphors can be transformed into comparisons,
these comparisons are themselves nonliteral and, consequently, still
need to be explained. (Author/AA)

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METAPHOR: THEORETICAL AND EMPIRICAL RESEARCH

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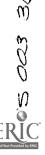Judith A. Arter
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2

Abstract

Metaphor plays a major role in our understanding of language and of the world we use language to talk about. Consequently, theories of language comprehension and of language itself are incomplete if they do not handle metaphor, and they are inadequate if they cannot. Traditional definitions and theories of metaphor are reviewed. It is suggested that they err in equating metaphors with comparisons rather than merely implicating comparisons. Empirical research is then reviewed, revealing, for the most part, serious problems, particularly in the developmental research. These problems often relate to inadequate underlying theories as to the nature of metaphor. Other difficulties include inadequate controls over pre-existing knowledge, and over-hasty conclusions that children cannot understand metaphors because in certain experimental conditions they do not select metaphorical interpretations. Related research on the comprehension of proverbs and analogies is discussed. Some recommendations for future research are made. These depend on a re-definition of metaphor and the case of an investigative approach which will permit adequate controls of pre-existing knowledge, surface-structure, and meaning. The approach emphasizes the context-dependent nature of metaphors, and takes advantage of it. Finally, the role of comparisons is revisited. It is of no avail to argue that metaphors are really implicit comparisons if, in so doing, it is hoped to account for, or explain, their non-literal nature. For, even if metaphors can be transformed into comparisons, these comparisons are themselves non-literal, and consequently still need to be explained.

3

Introduction

In the simplest and most obvious case of language comprehension, a
reader or listener understands what he reads or hears in terms of a literal
interpretation of what is written or said. Not surprisingly, therefore,
the bulk of research in the psychology of language comprehension has con-
cerned itself with the comprehension of literal uses of language. However,
in both written and oral language it very often happens that the speaker
or writer does not intend what he says to be taken literally, often
if it is it either makes no sense at all with respect to the surrounding
context, or it appears to express something that is either impossible or
false. It is our thesis that if research into the comprehension of natural
language is to have ecological validity, it is necessary that we go beyond
the more traditional research tract, and extend our investigations to non-
literal uses of language, which together with literal language, constitute
the whole range of linguistic communication.

One class of nonliteral uses of language that has recently started to
receive attention from psychologists is called "indirect speech acts."
This class will not concern us (but, see, for example, Clark & Lucy, 1975;
Schweller, Brewer, & Dahl, 1976). Rather, we shall be concerned with
metaphor and related figurative uses of language such as similes, and,
to some extent, analogies. Throughout our review we use the term "metaphor"
somewhat loosely; sometimes we use it narrowly to refer to specific utter-
ances which are or contain metaphors in the usual sense of the word; some-
times we use it more broadly to refer to related nonliteral uses of language
such as similes or analogies.

4

Extant theory and research concerning the development of the production
and comprehension of metaphor yields numerous opinions and contradictory find-
ings. For example, one group of studies (characterized by the work of Gardner,
1974; and Pollio & Pollio, 1974) suggests that even young children (age 5 or
younger) are capable of using and understanding figurative language. Other
research (Schaffer, 1930; Asch & Nerlove, 1960) however, suggests that these
capacities do not emerge until the child reasches adolescence. This kind of
inconsistency is. of course, not unusual in developmental research.

Implicit in our review is the suggestion that one of the reasons for
the non-uniformity of research findings is that research seems not to have
been grounded in an adequate understanding of what metaphor is. This is no
criticism of the theorists whose work we review; rather it seems to be endemic
in the history of thought about the problem. Metaphors may be easy to
recognize, but they are difficult to define. It is not easy to give a
psychological analysis of an ill-understood notion. This lack of understanding,
however, is not widely acknowledged, and entrenched beliefs about metaphor
are ubiquitous. Among these are such dubious claims as: Metaphors are
comparisons; metaphors are (must be) semantic anomalies; and the folklore
of classrooms and editors--metaphors, like drinks, should never be mixed.
As this review proceeds, we hope to show that the first two are false claims,
but we will digress here to discuss the mixing of metaphors. First, let it
be said that to our knowledge there is no theory of metaphor, or language
comprehension, or probably even of literary style that has the dictum "don't
mix metaphors" as a consequence. Indeed, the dictum is probably as groundless

as many others in the educational folklore of English teaching. Why should one not split infinitives? Why should one use "that" rather than "which?" And, as Winston Churchill once objected, why should one not end sentences with prepositions? Churchill's objection was voiced in the House of Commons when he finished a sentence with the phrase ". . . up with which I will not put." to demonstrate the absurdity of the dictum. Mixed metaphors, far from being heinous, can be very powerful and often rather amusing. In the recent campaign for the Republican party presidential nomination Ronald Regan probably expressed his intentions very vividly when he complained that the ship of state was sailing the wrong way down a one way street!

In a recent review of metaphor and psychological theory, Billow (1976) cites some of the studies that we do. However, we find Billow's review rather unsatisfactory. First, it ranges far and wide over psychology. For example, at one extreme it uncritically cites an unsupported Freudian interpretation of "I've wandered off the point and can't find it again" (Sharpe, 1968), in terms of a subconscious reference to failed childhood attempts to reach the mother's nipple. At the other extreme, it discusses fairly standard developmental literature without adequately reviewing its strengths and weaknesses. But more important, while acknowledging the confused state of the art by noting that "theory is incomplete and research is non-conclusive," little attempt is made to identify the root causes of this state of affairs and the review contributes little towards remedying them. The present review attempts to focus more on a cognitive approach and outlines some positive proposals. For although philosophers have been interested in the nature of metaphor at least since the time of Aristotle, there seems to have been relatively little progress since that

6

time. It is our contention that a prime reason for this is the relative inexactness and inadequacy of the dominant philosophical theories and definitions of metaphor.[2] A good definition is needed not, as Richards (1936) claimed "... to protect our natural skill from the interference of unnecessarily crude views," but rather to explicate that natural skill.

Metaphor: Traditional Definitions and Theories

For a long time, metaphors were considered to be merely the direct substitution of a nonliteral phrase for a literal phrase which had exactly the same meaning. Black (1962), in discussing this view, presents two reascns why authors would desire to replace a straightforward statement of what is meant with a nonprecise phrase, the meaning of which must be deduced. The first reason was stylistic. Metaphors presumably decorate writing. In addition, the reader was supposed to feel delight at the discovery of the hidden meaning. Secondly, metaphors were seen as useful in "coining" terms for new concepts, such as "leg" of a triangle (Breal, 1964). The substitution view allowed metaphor only a minor role in language. In fact, it led directly to the conclusion that the use of metaphor was an affectation which only obscured literal meaning. A modern example of such an opinion can be found in Millar (1976) who maintains that, "metaphors are often used in a misleading way to play upon the emotions or to carry an argument by means of distortion and overemphasis." Other approaches, however, have allowed metaphor to play a more important role in language functioning and development.

In our discussion, we will, wherever possible employ the terminology developed by Richards (1936). This terminology is both useful and quite

widely accepted. Richards argued that metaphors consist of two terms and the relationship between them. The subject term he called the "topic" or "tenor," the term being used metaphorically the "vehicle," and the relationship, or that which the two have in common he called the "ground." For example, in the metaphor "The question of federal aid to parochial schools is a bramble bush" (cited by Barlow, Kerlin, & Pollio, 1971), the topic is "federal aid to parochial schools," the vehicle is "bramble bush," and the ground is the idea of impenetrable complication. Richards further introduced the notion of "tension" to denote the literal incompatibility of the topic and the vehicle. In the example above, the metaphorical tension arises from the literal incompatibility of federal aid and bramble bushes. The identification of these various components of metaphor is not always as straightforward as in the example just given, but as an analytical tool Richard's terminology is often useful.

The comparison theory of metaphor. From antiquity to the present the most widespread view of the nature of metaphor is that it is essentially a comparison between or juxtaposition of objects which are literally disparate (Barlow et al., 1971; Perrine, 1971). The exact nature of the comparison, and the resulting implications concerning the use and comprehension of metaphor, varies from author to author. Some argue, as did Aristotle in the Poetics 1457[b], that it is comparison based on analogy or proportions. Others (e.g., Alston, 1964) argue that it is little more than implicit simile.

With the comparative theory of metaphor originating in the writings of Aristotle, it is appropriate to start with his views. Two aspects of

metaphor recur in his treatment of the topic. The first is that metaphor is

". . . constructed on (the) principles of analogy . . ." and seems to be

concerned primarily with the comparison of similarities ('resemblances') be-

tween two or more objects. This view of metaphor is still accepted in some

form by most present day theorists. However, most have expanded Aristotle's

basic view to encompass more than analogy. Aristotle seems to have thought

that a metaphor consisted of a topic idea "embellished or debased" through

comparison to (or resemblance to) an object idea.

A second interesting aspect of the Aristotelian view of metaphor con-

cerns the range of metaphor usage in natural language. In the Poetics,

Aristotle states that the command of metaphor is "... the mark of a genius,

for to make good metaphors implies an eye for resemblances." But if Aristotle

is right and the use of metaphor is a 'mark of genius', it would follow

that metaphors are rarely employed by the average user of language. In this

view metaphors are infrequent, and are used almost exclusively as ornaments

to make language more elegant and beautiful rather than more meaningful.

Aristotle makes this last point explicitly in the Rhetoric when he says

that a metaphor is created to be "... beautiful either in sound, in meaning,

or (in the image that it presents) to the sight or any other sense."

Breal (1964) took exception to Aristotle's implicit notion that the

ability to use metaphor was an uncommon occurrence. He suggested that

metaphor was a basic component of language use rather than an ornament

of language as Aristotle maintained. Breal claimed that ". . . the

metaphor remains such at the outset only; soon the mind becomes accustomed

to the image; its very success causes it to pale; it fades into a representation

of the idea scarcely more colored than the proper word .... it must be admitted that for the most part metaphors teach us little save what we knew already; they demonstrate only the universal intelligence, which does not vary from one nation to another" (p. 122). For Breal, the original use of metaphor is common among most language users and is an important vehicle for language change.

Stated in more modern terms, Breal also makes a distinction between "novel" and "frozen" metaphor. In discussing this distinction, it is perhaps useful to think in terms of a continuum, with frozen or dead metaphors at one end and novel metaphors at the other. Frozen metaphors would then be defined as metaphors that at one time were novel but through consistent use have become integrated into the language. Phrases like "head of state" and "foot of the bed" are examples of frozen metaphors as are many colloquial expressions. In contrast, truly novel metaphors constitute an original contribution by the speaker to the content of his language (Barlow et. al., 1971). Most of the metaphors occuring in everyday language probably lie somewhere in the middle of the continuum rather than at either of the extremes. These metaphors are not totally original to each person who uses them but are definitely not frozen.

Embler (1966) took Breal's hypothesis one step further by suggesting that metaphor was not only a building block of language but also the essential transporter of meaning in language. Embler suggested that "Both speech and thought are often fuzzy and vague, often poverty-stricken, often mere counters of approval or disapproval, often abstractions that have lost their power of expressiveness. But, if there is meaning at all, it is in the metaphor still" (p. 44).

Barlow et al., (1971) presents a simple comparison view of metaphor as part of a more general classification scheme for non-literal language. Metaphor for them is "an implied comparison between two things of unlike nature that have something in common." Using simple, indeed over-simple, examples such as "my mind is a blank" they argue that the attributes of the vehicle are compared to those of the topic in order to generate the "meaning" of the metaphor. Other authors have developed more complex accounts.

For example, Campbell (1975) presents a theory of metaphor as comparison in which every metaphor is an implicit oxymoron. An oxymoron is a juxtaposition of two concepts that have opposite (as opposed to merely different, or incompatable) meanings, such as "the soft harshness of words." Even metaphors that do not contain such obvious opposites can be thought of as oxymorons because the tension in the metaphorical comparison comes about as a result of the incompatibility of the literal meaning of the topic and vehicle of the metaphor. Although the sphere of nonliteral language that is denoted by "metaphor" is not made explicit, Campbell has strong opinions about the implications of his view of metaphor for cognitive ar linguistic theory. The power of metaphor comes from its inability to be paraphrased. Campbell notes that "the more powerful the metaphor, the easier it is to per- ceive the multiple meanings nestled therin." These multiple meanings are, how- ever, not static. New meanings can evolve with different individuals at dif- ferent times. Therefore, any attempted literal paraphrase will of necessity miss some of the meanings of the metaphor. Campbell also notes that the mul- tiple meanings of metaphor, and the intelligible presence of opposites in the same sentence provide difficulty for many theories of semantic processing. Whereas Campbell is probably right about this the only theory he discusses in

11

detail is the linguistic theory of Katz and Fodor (1964) which is not a

processing theory at all.

The Interactionist theory of metaphor. Several authors (Black, 1962;

Haynes, 1975; Richards, 1936; Wheelwright, 1962) maintain that while metaphors

can be merely substitutes for literal statements, and while they can be com-

parisons between objects, the psychologically interesting metaphors really

involve more. Good metaphors actually relate the thoughts present concerning

two subjects, resulting in a meaning that is new and which transcends both.

"Placing known characteristics of Y against X may provide new insights,

either about Y or about X or about a new third Z, an irreducible synthesis

by juxtaposition which is difficult to reduce to a simile or literal language

language --- the metaphor creates the similarity rather than (formulating)

similarity previously existing" (Haynes, 1975).

Black (1962) views the interactive approach to metaphor as an interplay

between both of the two major components (topic and vehicle) of metaphor

which he calls the principal subject and the subsidiary subject. The metaphor

works by selecting or suppressing features of the principal subject by using

features from the subsidiary subject. For Black, the interactive metaphor

can be characterized by the following conditions:

1) A metaphorical statement has two subjects - a principal subject

   and a subsidiary one.

2) These subjects are often regarded as 'systems of things' rather

   than 'things.'

3) The metaphor works by applying to the principal subject a system

   of 'associated implications' characteristic of the subsidiary

   subject.

4) These implications usually consist of 'commonplaces' about the
subsidiary subject, but may, in suitable cases, consist of
deviant implications established ad hoc by the writer.

5) The metaphor selects, emphasizes, suppresses, and organizes
features of the principal subject by implying statements about
it that normally apply to the subsidiary subject.

6) This involves shifts in meaning of words belonging to the same
family or system as the metaphorical expression; and some of
these shifts, though not all, may be metaphorical transfers ....

7) There is, in general, no simple 'ground' for the necessary shifts
of meanings--no blanket reason why some metaphors work and others
fail (p. 44).

Black suggests that since both substitution and comparative metaphors can be
replaced by literal translation they could be dropped from language with no
loss of cognitive content. Interactive metaphors, however, are not expendable
because they require readers to make inferences and implications rather than
merely to react.

Wheelwright (1962) in his influential text, Metaphor and Reality, pro-
poses what he calls a "tensive view" of metaphor. His concepts, however,
seem amenable to interpretation in a broad interactive sense, and will, there-
fore, be discussed here. He analyzes metaphor into two component types,
"epiphor" and "diaphor." Epiphor "starts by assuming a usaul meaning for a
word; (then applies) that word to something else on the basis of, and in order
to indicate a comparison with what is familiar." In essence Wheelwright's
notion of epiphor encompasses metaphor in the conventional sense as we have
discussed it. It expresses a similarity between relatively well known and

13

relatively unknown subjects. His conception of diaphor, however, seems to add a new dimension to metaphor as previously discussed. Diaphor is exemplified by ". . . 'movement' (phora) 'through' (dia) certain particulars of experience in a fresh way, producing new meaning by juxtaposition alone" (p. 78). In other words, phrases and sentences that may or may not be metaphorical in their own right can create a metaphorical image when placed together in a communication. Wheelwright presents an example of diaphor: "My country tis of thee, sweet land of liberty, higgledy-piggledy my black hen." The intention here, he claims, is not to say anything concerning hens or countries, but rather to make an unpatriotic statement. In diaphor, context with all of its nuances is introduced into the study of metaphor.

The interactionist view of metaphor approaches metaphor functionally rather than grammatically. Thus instead of arguing that a metaphor is a simile without the word "like" or "as," a true metaphor, for the interactionist, is characterized by a "eureka" effect as the elements blend and the new whole is recognized. Haynes (1975) specifically mentions that even similies can have this characteristic if the tensive force in the simile is great enough, as in, for example, "Oh my love is like a red red rose."

Now, while it may be true that proponents of the interactionist view see metaphor in a radically different way from proponents of the comparison view, it may be that the one is still reducible to the other. Perrine (1971) has developed a four category classification scheme for metaphors and comparisons. These categories represent the four possible combinations of explicit or implicit tenor and vehicle. The first category is the one in which both the tenor and vehicle are explicitly stated. Such a metaphor might be "The issue of federal aid to parochial schools is a bramble patch." Here, "federal aid to parochial schools" is being explicitly compared to

14

"bramble patches." A second category contains metaphors in which the "real"

vehicle is not explicitly stated, while the "real" tenor is. One of Perrine's

examples of this category is "sheathe thy impatience." The topic is "impa-

tience" and the unstated vehicle is "sword." The metaphor, he claims, com-

pares the two. The third category that perrine describes contains metaphors

in which the vehicle is explicitly stated but in which the topic is not.

Many proverbs fall into this category in that the literal term is not explic-

itly stated but the vehicle is. For example, in "don't put the cart before

the horse" the literal term is some action having the characteristic of being

out of order. Finally, the fourth category consists of metaphors in which

neither the topic nor the vehicle is explicitly, such as "Let us eat, drink,

and be merry, for tomorrow we shall die" when used to assert that life is

short and should be enjoyed while it can be.

Of Perrine's four categories of metaphors, it seems that only metaphors

in the first category (those having an explicit topic and vehicle) would be

considered by interactionists as being metaphors of comparison. The examples

that the interactionist give to illustrate the process of interaction, how-

ever, could be merely examples of the other three kinds of comparisons. If

this is true, then the "eureka" aspect of interactive metaphors, referred to

by Haynes (1975), may be really only the result of discovering what the real

vehicle and/or topic of the metaphor is.

Whether or not this is the correct interpretation, the interactionist

viewpoint presents an interesting picture of the power and usefulness of

metaphor. Wheelwright (1962) holds that "in order to speak as precisely as

possible about the vague, shifting, problematic and often paradoxical phe-

nomena that are an essential part of the world, language must adapt itself

somehow to these characteristics" (p. 43). Thus figurative language,

15

especially metaphor is essential to creative thought. We cannot speak of new

perceptions and insights into how objects or ideas fit together in terms of

language which has only fixed meanings. These views are echoed by Haynes

(1975) who feels that the new insight provided by a good metaphor suggests

further questions "tempting us to formulate hypotheses which turn out to be

experimentally fertile." She implies that good metaphors can literally lead

to reasoning by analogy which can give further insight into the extent and

nature of concept interrelation both in suggesting theoretical tests of hypo-

theses and in personal world views. An example in the scientific domain would

be the comparison of the atom to a solar system, which suggested a new view of

atoms, and one that led to innovative experimentation to explore the extent of

the analogy.

Conclusion. "Metaphor" is usually taken to designate just one aspect of

natural language functioning. It has been argued, however, that metaphors play

a much greater role in language and cognition. To some extent this was Breal's

position. However, care has to be taken not to overstate this position. For

instance, Shibles (1974), in an extreme example of this approach, views every-

thing as metaphor. He defines metaphor as "nonliteral statement or represen-

tation of something else," thus permitting the term to cast its net too wide.

According to this view, all of language and cognition is metaphorical. Con-

sider, for example, the noun. A noun is not the same as the object(s) it

designates; it only stands for the concept. Therefore, Shibles claims, a noun

is a metaphor. Likewise, such things as theories, systems of equations, and

models are not the phenomena they hope to describe; they are only our descrip-

tions of those phenomena. They designate only the features of the phenomena

that appear to be useful or consistent to us according to our current knowledge.

16

Such a view of metaphor defines a domain of reference too broad and too general to be useful. It requires that we still designate a subdomain of interest, namely that domain covered by what we normally call "metaphors," which leads us back to the original problem of definition. If literal uses of language are really metaphorical, as Shibles' view implies, we still want to know how non-literal uses are different.

It would seem that one should reject those accounts of metaphor which trivialize it by assigning it an insignificant role in language and cognition. There are good reasons for rejecting simple substitution views, for example. By the same token, views which are too all embracing have to be rejected for they distinguish nothing. Our own view is that metaphor is a pervasive, powerful and necessary phenomenon which needs to be accounted for in both linguistic theory and psychological theory. Metaphors serve many functions. They are vehicles for linguistic change, as Breal saw. This change is effected by the gradual absorption into the lingua franca of expressions which were once novel. We no longer think of "cars running" as a metaphor, or of "legs of triangles" or of "catching colds." The emergence of such "dead metaphors" in a language attests to the fact that there are gaps in what is, or was, literally expressible. Thus, one of the functions of metaphors must be to permit the communication of things which cannot (or could not) be literally expressed. They permit the formulation and recognition of new relationships (Campbell, 1975; Ortony, 1975, 1976; Wheelwright, 1962).

Metaphors fullfil other functions too. They are powerful in their capacity to relate new knowledge to old, and consequently they have great pedagogical value (Green, 1971; Ortony, 1975). In addition it can be argued (see, Ortony, 1975) that they may provide the possibility of communicating

17

a more wholistic and vivid impression of a phenomenon.

If metaphors have these features, then elements of both the comparison theory and the interactionist theory come into play. On the other hand, it is by no means clear that metaphors are comparisons, although it is clear that they may involve comparisons. It is surely true that metaphors are sometimes used for the purpose of making or indicating a comparison, but on other occasions they may be used to engender a new way of seeing things, as the interactionist view emphasizes. Thus, a more cautious account of the relationship between metaphors and comparisons would be to invoke comparison as a component in the process of comprehending metaphors rather than neces- sarily the end result of that process. If it is asserted that metaphors are comparisons, we will need to explain the difference between literal and metaphorical comparisons, a difference that we will return to in due course.

Review of Empirical Research

In spite of the lack of unanimity as to the nature and function of metaphor, there has been some empirical research that examines various aspects of the comprehension and production of metaphors both in children and in adults. Our review is of selected work and is by no means exhaustive, but the research that we discuss is representative. We also look at some work in related areas such as analogy.

Developmental research. Developmental research into the comprehension of metaphor is becoming quite a fashionable pastime. It is a topic that is appearing more and more frequently in the pages of leading developmental journals. This increasing interest is an excellent sign, for the question

concerning the child's ability to comprehend metaphors is not only of theoretical interest but of practical importance as well, particularly in reading. It appears to be the case that children need to be able to understand metaphors to understand the texts that they typically encounter in school. For example, Arter (1976) conducted an informal survey of readers and introductory social science texts which are widely read by fifth and sixth grade children. She found that in the Ginn 360 reading series, figurative language occurred at the rate of about ten instances per 1000 words. Even for the earlier grades (Ginn 360, Primer level) the rate was about 2.5 per 1000 words of text. Although a more detailed analysis of the frequency and use of metaphors in reading materials would yield more precise results, it is evident that in order to understand many school texts, children have to understand the metaphors that occur in them. It thus becomes important to know whether there are cognitive constraints on the comprehension of metaphor by children, and if there are, it becomes important to understand the relationship between the literal uses of language that the child can understand, and the non-literal uses that he perhaps cannot.

Asch & Nerlove (1960) examined the development of "double function" terms in children. Double function terms were defined as words that can refer to either physical or psychological phenomena. The physical application was held to be literal, while the psychological application was regarded as metaphorical. Forty children between the ages of 3 and 12 were tested. Asch and Nerlove chose 8 double function words, sweet, hard, cold, soft, bright, deep, warm, and crooked, and asked their subjects whether such terms could be applied to people. If the child said "yes," he was requested

19

to describe what such a person would be like, and whether there was any connection between this and the physical meaning. Their results showed:

"(1) Children first master the object reference (i.e., the literal use) of double function terms.

(2) Children acquire the psychological (i.e., metaphorical) sense of these terms later, and then apparently as a separate meaning, as if it were independent of the object reference.

(3) The dual property of the terms is realized last, and even then, not spontaneously" (p. 55).

Asch and Nerlove concluded that the capacity to appreciate and produce good metaphor does not emerge until adolescence. There are some problems with this study, however. First, it could be argued that the double function terms that Asch and Nerlove investigated are ambiguous terms, having at lease two distinct lexical entries. If this is the case, it would not be surprising to find that the psychological senses of them develop later, on the grounds that the domains to which they can be applied are less well understood by younger children. That the terms are not perceived as being related by children, in fact provides some evidence for the ambiguity inter-pretation. Consequently, the findings may have little to do with the devel-opment of the capacity to understand metaphors at all. A second problem concerns the relationship between comprehending metaphors and explaining the basis of the putative comprehension. To investigate cognitive/linguistic skills by making demands on metacognitive/linguistic skills is not a very promising approach. To be sure, if a child can explain how he interpreted something then one can draw inferences about his comprehension skills (as well as his skill at understanding his comprehension, and articulating it).

But the fact that a child cannot report how he understood something does not

in itself justify the conclusion that he didn't. Problems of this kind are

widespread throughout the developmental literature (see, for example,

Brainerd, 1973; Brown, in press; Kuhn, 1974).

Studies by Billow (1975) and by Winner, Rosensteil, and Gardner (1976)

attempt to show that the development of genuine comprehension of metaphor is

related to the child's ability to deal with formal operations, although ac-

knowledging that some "primitive" form of comprehension is in evidence even

in 5 year olds. Billow used children ranging in aged from 5 to 13 years old.

He distinguished between two kinds of metaphors, "similarity" metaphors and

"proportional" metaphors. In similarity metaphors, he argued, two disparate

objects are compared on the basis of a shared attribute, as in, for example,

"The branch of the tree was her pony" where both the branch and the pony are

ridden. In porportional metaphors such as "Summer's blood is in ripened

blackberries," Billow argued that "four or more elements must be compared,

not directly, but proportionally." Thus, proportional metaphors are implicit

analogies. Billow also looked at the children's ability to comprehend proverbs.

His results show that where the similarity metaphors were accompanied by

pictures 5 year olds could explain the basis of the metaphor about 30% of

the time. However, the proportion correctly explained was nearly 75% for

7 year olds and almost perfect for 11 year olds. Billow also reports that

"...a stable use of concrete operations (as measured by the inclusion test)

is not a necessary condition for metaphor comprehension" (p. 419). With

respect to the "proportional metaphors" the results showed a high correla-

tion between the child's ability to explain the metaphor and the development

of formal operational thought. This part of the study was only undertaken

with children aged 9 through 13 where performance improved from about

21

40% correctly explained to about 80% correctly explained. However, the apparent ability to engage in formal operations, while used to explain performance on the proportional metaphors, failed to explain the poor performance on the comprehension of proverbs.

A simpler explanation of Billow's findings might be just that the items he chose were of increasing difficulty on all kinds of dimensions. It is clear, for example, that overall, the proverbs involved more complicated, syntactic constructions, a greater proportion of relatively low-frequency words, and far more complicated demands on knowledge of the world, physical, social, cultural and proverbial. The increase of comprehension with age almost certainly reflects nothing more nor less than a greater probability of an already learned acquaintance with more of the proverbs. Similarily, the proportional metaphors are indeed more complex in structure than the similarity metaphors, and they too involve more knowledge of various kinds. Indeed, the authors of this review found some of them very obscure. We are inclined to attribute the problem to the stimulus materials rather than to the absence of our own formal operations!

This study is noteworthy for its problems. Again we see the demand on metacognitive skills; they are as likely to be age and stage related as in the comprehension of figurative language itself. Again we see problems with the underlying theory. How can ponies and branches share the attribute of being ridden? The whole point of the metaphor is that the branch is being ''ridden''metaphorically.' Finally, the results seem to allow one to conclude little more than that more difficult linguistic/cognitive tasks are performed better as children grow older.

Good empirical work on the development of metaphoric understanding must control for pre-existing knowledge. The failure to do this renders the Billow study rather unrevealing, and it also turns out to be a problem for the interesting study described in Winner et al., (1976). They hypoth-esized three levels of metaphoric understanding prior to mature comprehension. The first level is the "magical" level, the second the "metonymic," and the third they refer to as the "primitive metaphoric." Each of these levels, they suggest, can be regarded as a stage in the development towards the mature comprehension of metaphors. At the magical stage the interpretation is made literal by the mental construction of a suitable scenario or magical word. At the metonymic stage the terms in the metaphor are taken to be somehow asso-ciated, and in the "primitive" stage true metaphoric comprehension is partially present. For example, one of the items they presented was "The prison guard was a hard rock." The magical interpretation would be that the guard was (turned into) a rock. The metonymic might be that the guard worked in a prison with rock walls, and the primitive metaphoric that the guard was physically tough or hard. Children between 6 and 14 years of age were read the "stories"-actually just context-independent sentences - and they either tried to ex-plicate the meaning, or they selected the meaning in a multiple choice test. Their results showed that metonymic and primitive responses were predominant for 6, 7 and 8 year olds. Genuine metaphoric responses dominated those of 10, 12 and 14 year olds. The younger children had fewer magical responses than metonymic and primitive, but more than older children. These results do sug-gest that older children are more likely to select or offer genuine metaphor-ical interpretations than younger ones. They do not, however, establish that younger children cannot properly interpret metaphors. In the multiple choice

condition, for example, there may have been a response bias in favor of inter-

pretation consistent with the kind of stories children read. Young children

are exposed a great deal to stories about magical worlds. Perhaps a more

serious problem lies in the fact that the stories were not really stories at

all; they were isolated sentences without contextual (textual) support. It

is almost certainly the case that the ability to deal with isolated sentences

improves with age. Finally, the explication task again makes demands on meta-

cognitive skills. It might be interesting to replicate the multiple choice

condition but to present the choices in order of difficulty as hypothesized

by the stage approach. If the first choice were to be genuine metaphoric and

the last magical, the child would be given a better chance to entertain the

possibility of a genuinely metaphorical interpretation. The real question to

be answered is can young children understand metaphors? To answer it, they

must be given the maximum opportunity to do so since their relatively impov-

erished knowledge of the world and of the conventions of figurative language

mislead them into selecting more familiar interpretations.

Gardner (1974) conducted a study to determine whether or not the ability

to make metaphoric links could be found in preschool children. Also an exam-

ination of the development of the ability to comprehend metaphor was attempted.

Gardner proposed that the ability to project sets of antonoyms or "polar

adjectives," whose denotation within a domain is known, into a domain where

they are not ordinarily employed, could be considered a demonstration of the

ability to comprehend metaphor. The experimental procedure involved using

five pairs of polar adjectives as stimulus items to be mapped onto diverse

domains. These items were presented to 101 subjects at four age levels: the

mean age of subjects in each of the groups was 3.5 years, 7 years, 11.5 years,

and 19 years. Subjects were given a set of stimulus words (e.g., cold/warm) and told to relate them to other adjective pairs, which encompassed five different modalities (example, blue/red, which color is cold and which is warm?). The results showed a decrease in the number of errors made with increasing age except for the two oldest groups. Preschoolers, however, averaged only 8.91 (of 25 possible) errors. Gardner noted that close analysis of the data revealed several factors which seemed to contribute to the superior performance found in older subjects. These factors included the knowledge of physical laws, cultural conventions, a variety of connotative meanings for words, and the ability to find abstract connecting terms. Gardner's conclusions were that preschool children could perform metaphorically at adult level if the metaphors lay within the realm of their experience. A problem with this study might be the role of pre-established associations. Thus relatively high performance of even the young children might be due to their previous acquaintance with expressions such as "red hot," or "blue with cold." Consequently, it is not clear that the task Gardner chose exploits or reflects childrens ability to handle metaphor.

Gentner (in press) compared children and adults on the basis of a task rather different to those used in the studies cited so far. She suggested that having subjects try to map body parts or facial features onto pictures of objects (mountains, cars and trees) would provide a test of metaphorical ability insofar as the later had an analogical component. In the experiment, subjects (20 children aged 4-5 ½ and college sophomores) were asked questions of the form: "If the mountain (in the picture) had a nose where would it be?" The results of the study indicated that the children were as good at the task as were adults. Gentner concludes that her results

"weaken the position that young children lack metaphorical ability, and
are compatible with the hypothesis that such ability is present at the out-
set of language use."

Most of the research that we have discussed so far seems to suggest that
whereas the ability to comprehend metaphors increases with age, there is some
rudimentary ability quite early on. We now move on to look at some more
naturalistic investigations, into both production and comprehension. We shall
also examine the effects of attempts to train children to comprehend metaphors.

Grindstaff and Muller (1975) reviewed and summarized a national asses-
sment on response to literature. One aspect of this assessment consisted of
determining the ability of children to comprehend metaphor. Subjects in-
cluded persons aged 9, 13, 17 and adult. Results indicated that comprehen-
sion of metaphors increased with age up to age 17. Adult performance dropped
off somewhat. This result was attributed to the effect of adults being out of
school. Even though comprehension increased with age, 45% of the 9 year olds
were able to understand each metaphor. Sweet (1974) looked at the use of non-
literal language development in writing in grades four through six. He took
three kinds of samples from 81 subjects, a poem, a description, and a story.
Scoring of the samples was done in terms of the occurrence of alliteration,
apostrophe, hyperboles, irony, metaphor, personification, and simile. Sweet
found that more nonliteral language was found in the poems and the descrip-
tions than in the stories. No increase in usage was found between grades.
As a final analysis, Sweet had a panel of "expert" judges rate the quality
of each of the student's productions. He found that the judges tended to
consider the use of figurative language indicative of superior products.
Because of this result, Sweet suggested that instruction in the use of

figurative language be built in composition curricula at grades four through

six. When such instruction is attempted, there is evidence (Horne, 1966;

Pollio and Pollio, 1974) that it is effective. This seems to be true both

for instruction in using figurative language, and for instruction in under-

standing it. Pollio and Pollio (1974) examined the ability of third to sixth

grade children to use figurative language. They also compared two methods

for increasing such usage: a commercial series of instructional texts

designed to increase figurative language production, and a set of author made

lessons. Tasks of composition, elaborating comparisons between objects, and

generating multiple uses for objects were included as the dependent variables.

Results indicated (1) that children use metaphorical language as early as

third grade, (2) that children used more dead than novel metaphors in their

compositions and descriptions of multiple uses for objects, (3) that children

use more novel than dead metaphors in the comparison task, and (4) that this

pattern changed somewhat with grade, achievement level, and socioeconomic

status.

Horne (1966) attempted to teach sixth graders how to comprehend figures

of speech. He presented 73 sixth graders with 24 word sessions spread over

seven months. The sessions were designed to increase comprehension of the

anological nature of figurative language and to increase the production of

such language in the children's writing. When compared to 72 children who

had not received the training, the experimental group performed significantly

better than the control group on the comprehension of, but not the use, of

figurative language. Age, sex, and socio-economic status were not related to

either comprehension or use of metaphor. Intelligence was related to compre-

hension but not to use. This study demonstrated that children can be taught

to increase their comprehension of metaphor.

That there is a close topical connection between metaphor and analogy is undeniable. Both the Gentner study and that by Horne capitalize on it. We therefore will discuss a couple of studies explicitly concerned with the development of analogical reasoning.

Khatena (1973) examined the ability of children and young adults between the ages of eight and nineteen to produce analogies. He chose his subjects on the basis of high scores on a test he developed called "Onomatopoeia and Images." This test consistend of presenting stimulus words and having the individual produce a word image for it. The responses of the 284 highest scoring subjects were analyzed to determine which kinds of analogies these "high creative" children were using. Khatena classified his analogies into four types: personal (comparing oneself to another thing); direct comparisons between objects; symbolic (comparing object which all symbolically represent the items of reference, such as "sharks tearing at a marlin" for critics analyzing writers); and fantasy (one part of the comparison is an imaginary phenomenon such as Satan). Khatena also classified the level of each analogy. Simple analogies were single words that expressed single thoughts. Complex analogies required several inferences. Of a total of 4,960 analogies, 83.6% were direct comparisons; of these 81.2% were single. Although the ability to produce complex analogies did increase with age. Khatena concluded from these findings that relatively young children can produce creative analogies, and that creativity can perhaps be taught by instructing people to use simple, direct analogies.

Levinson and Carpenter (1974) considered the ability of 42 children, aged 9, 12, and 15 to complete quasi and true analogies. True analogies

were structures, as, for example, "Birds are to air as fish are to _____,"

whereas the corresponding quasi-analogy would be "Birds use air, fish use

_____." Thus, quasi-analogies actually specified the relationships

while true analogies did not. The results showed that 9 year olds did sig-

nificantly better on the quasi-analogies than on the true analogies, but were

still able to complete 50% of the true analogies (8 of 16). Both the 12 and

15 year olds performed the same on the quasi and true analogies and were sig-

nificantly better than the 9 year olds in both cases. The ability to give

reasons for the choices made on the analogies increased with age. The impli-

cations of Levinson and Carpenter's study were threefold. First, nine year

olds can use analogies and the ability to do so increases with age although

performance is fairly stable between ages 12 and 15. Second, the ability to

explain choices grows with age. Third, perhaps quasi-analogies can be used

to increase skill in true analogies.

Conclusion

Developmental research into the comprehension of metaphor seems to be

plagued with many and difficult problems. These problems tend to be shared

and include such things as inadequate controls over pre-existing knowledge,

inadequate control over difficulty of materials, and over-reliance of meta-

cognitive/linguistic skills, and the utilization of experimental tasks not

clearly related to the comprehension of metaphor. It is interesting that

children can be taught to improve their comprehension of non-literal uses

of language and it is also interesting that they appear to have reasonable

analogical skills at an early age. The possibility therefore exists that

the decrements in performance for young children could be largely accounted

for in terms of a paucity of relevant experience of the world and of the use

of metaphors, rather than to the constraining influences of cognitive devel-

opment. A greater emphasis on determining whether there are any conditions

under which young children do comprehend metaphors, and if so what those conditions are, might be more revealing than more categories of developmental trends.

In defense of those who have been working in the field, it should be noted that the area is very difficult to investigate and many of the problems appear, at least at first sight, to be inherent in the nature of the field. Literal controls are often difficult if not impossible to generate especially if the emphasis is on investigating metaphorical uses of individual words. We will have more to say on this issue later on.

Finally, in looking at the production of metaphors and the results of training, care has to be taken in judging what is and what is not true metaphor. Matter and Davis (1975) address this problem in their discussion of the developmental research done on metaphor:

"In early stages of language acquisition children produce categorical errors and mistakes that can be taken as metaphorical expression but are not. The child is in the process of learning to recognize and correct perceptual, cognitive, and conceptual 'error'....
As these 'errors' are corrected, children develop a highly literal linguistic behavior. In this intermediate stage, children are getting their categories straight ....Following the literal stage. children again enter the world of category mistakes intentionally....
they discover metaphor"(p. 75).

In short, the expressions scored as metaphorical in some of the research cited above might simply be a child making a "perceptual, cognitive or conceptual error." This cautionary note is also important for research on older subjects.

Research with mature language users. Serious empirical investigations

into the comprehension of metaphors in adults is much less widespread than

developmental research. There is, however, quite a lot of research on re-

lated issues, of which we will discuss only a little.

Koen (1965) suggested a psycholinguistic orientation to the study of

metaphor. A prerequisite of this orientation is the assumption that literal

terms and metaphors can be connected by common verbal associations in a

semantic interface (the interface contains associations common to both the

literal and metaphorical terms). Differences between metaphorical and literal

meanings are characterized by unique associations. Koen predicted that

metaphorical meanings could be derived from literal meaning through a search

for common linking associations. Koen tested his hypothesis by having sub-

jects view sentences like:

The sandpiper ran along the beach leaving a row of tiny $\left\{\frac{\text{stitches}}{\text{marks}}\right\}$ in the sand.

In accordance with the verbal associative hypothesis Koen made three specific

predictions: (a) cue words originally generated from the metaphorical terms

should elicit the choice of the metaphoric terms most often, (b) cue words

associated more frequently with the literal term should promote the choice

of that term, (c) interfaced associations should cue both terms equally well.

The results mirrored these predictions exactly. But, as with so many of the devel-

opmental studies, this study suffers from a weak connection between the experi-

mental task and the comprehension of metaphor. Indeed, it seems to reduce to

a demonstration that highly associated words tend to be good cues for one

another. Furthermore, the verbal associative argument itself is not well

developed. Complex metaphors with many different facets would not be easily

handled by it, although to some extent, this criticism is a general problem

for laboratory investigations into the comprehension of metaphor. Finally, Paivio (1971) has suggested that an imagibility interpretation could be made with the data. The cue words might simply be arousing images of the choice words, thereby facilitating their selection.

Perhaps the best studies carried out with either adults or children are those described by Verbrugge and McCarrell (1973). They take the position that metaphors work by making assertions through the use of comparisons. An example of one of their items is the metaphor "Billboards are warts on the landscape." Here "billboards" is the topic, "warts" the vehicle, and the ground is something like "an ugly protrusion on a surface." Verbrugge and McCarrell suggested that in order for comprehension of a metaphor to occur, the unexpressed ground between the topic and the vehicle must be inferred at acquisition. ' this assumption is true, then according to the principle of encoding specificity (Thomson & Tulving, 1971) the inferred ground should be an effective recall prompt. To test this hypothesis, two lists of fourteen metaphors and similes were prepared. Topics for each list were held constant while the vehicles (and hence the grounds) were allowed to vary. For example, list A might compare billboards to warts while list B would compare billboards to yellow pages. The experimental sentence lists were presented to subjects (via tape recording) along with instructions to think about and understand the sentences. After completion of the list presentation, subjects re-ceived booklets containing written prompts. These prompts were either grounds (relevant or irrelevant), topics, or vehicles from the presented sentences. The subjects' task was to respond to each cue by writing the appropriate presented sentence. The results were reported in terms of the mean number of sentences recalled. Vehicles and topics prompted the best

recall with relevant grounds close behind. Irrelevant grounds were signif-
icantly less effective than the other three prompts. Clearly, the most
important finding was the high level of recall produced by relevant grounds
(10 of 14 sentences). It was concluded that relevant processing at acquisi-
tion facilitated ground effectiveness as a recall cue. Also, irrelevant or
conflicting acquisition experience interferes with this effectiveness.

Verbrugge and McCarrell reported a second study which provided a needed
control condition for the first experiment. The control condition involved
the presentation of a topic-only list in an effort to provide a measure of
the effectiveness of grounds as cues when no biasing direction was availiable
at input. During the recall test, both relevant and irrelevant grounds were
used as prompts. Subjects were asked to recall only the topics. With these
exceptions, the experimental tasks and procedures were the same as in the
first study. Recall for topics presented in sentence form, given relevant
and irrelevant grounds as cues, was consistent with results from the first
experiment. Recall in the topic only condition was located between the two
sentence conditions. Both the facilitative effect (relevant grounds) and
the interference effect (irrelevant grounds) were highly significant. The
medial location of the topic-only condition was theoretically interesting.
If metaphor affected comprehension in such a way as to channel attention
toward only some of the aspects of the topic, the recall of the irrelevant-
ground and topic-only conditions should have been similar. The actual data
suggested that both selective attention and repression qualities are in-
volved in metaphor comprehension. Also, normative data were reported with
the second experiment which suggested a lack of evidence for an associative
interpretation of the experiments.

In summary, Verbrugge and McCarrell draw the following conclusions from their research: (1) comprehension of metaphor is both easy and consistent for adults, (2) comprehension of metaphor involves inferring an implicit, but relevant, comparison between the topic and vehicle, and (3) metaphor directs attention to some aspects of the topic at the expense of others. Although a comprehensive account of the workings of all metaphors (those that do not involve a direct comparison) is not offered, the Verbrugge and McCarrell studies contribute much more than most.

Mayer (1975a; 1975b) provides evidence that metaphors can create relevant learning sets. He presented information about computers to naive students in one of two ways: by use of a model or by applications of rules. His model condition consisted of comparing various functions and aspects of computers with familar situations, in other words, using a complex metaphor. For example, input was compared to a ticket window, output to a message pad, the memory to a chalkboard. The literal presentation consisted of a flow chart representation of computer function, with practice on interpretation and application of rules. Mayer hypothesized that the model condition would facilitate external connections and those subjects in it would be better able to produce new examples, while the rule condition would facilitate internal connections, and subjects in it would be better able to produce flow charts. These hypotheses were confirmed. Models were shown to produce the learning sets postulated by Mayer (1975a). However, it should be noted that the rule treatment, consisting of flow-charting, could also be thought of as a metaphor for computer functioning in which case the study reduces to a comparison of the effectiveness of different representational systems. It would have been interesting to see how the student's previous knowledge of flow-charting or

the other analogies interacted with the treatments.

In a series of studies (Royer and Cable, 1975, 1976; Royer and Perkins, 1975) on facilitating transfer in prose learning, Royer and his associates demonstrated not only that the elicitation of a relevant knowledge set is an aid to learning but also that text materials containing analogies can be used to advantage in facilitating transfer. Royer and Cable (1975) presented subjects with a difficult abstract passage which was preceded by either a concrete passage (describing physical phenomena by analogy to common events) designed to provide a structure into which the second passage could be assimilated, or by an unrelated control passage. These two conditions were compared to a third condition in which the abstract passage was presented first and followed by the passage with analogies. Results showed that subjects' performance in recall of the concrete passages was not effected by the time of presentation (before or after the abstract passage), but that when an abstract passage was preceded by a concrete passage subjects recalled at least 40% more material than those who received the abstract passage first. Royer and Perkins (1975) showed that the pattern of results was maintained in delayed recall. Royer and Cable (1976) attempted to rule out the possibility that the results from their previous study were due to style (concrete or abstract) rather than content (presence or absence of analogies as assimilative aids). The previous results may have been due not to the availability of an assimilative set, but to the fact that having an easy passage first increased attention to the subsequent difficult passage. Therefore, the authors compared the effectiveness of preceding an abstract passage with a concrete passage containing analogies, another abstract passage, an unrelated passage, and abstract passage with analogies (therefore having the same type but different content) or an

abstract passage with illustrations. Results showed that the initial easy

concrete passage, abstract passages with analogies and abstract passages

with illustrations all facilitated acquisition of the subsequent abstract pas-

sage, while the control and abstract passages did not. This indicated that

transfer was facilitated by content not style. The entire series of experiments

also revealed that concrete passages which contained analogies could elicit

a relevant learning set which facilitated learning.

Although the next studies to be discussed do not deal specifically

with metaphor or analogy, they are concerned with related subjects. It is

hoped that discussion of these related areas might allow some insight into

the functioning of figurative language. Bock and Brewer (1976) describe a

study concerned with the literal and figurative interpretations of proverbs.

Their primary purpose was to demonstrate that subjects process both the

literal and figurative interpretations of proverbs, and that using a pro-

cedure designed to enhance figurative comprehension will greatly improve

the level of figurative recognition.

The experimental materials were composed of proverb sets containing six

members each: (a) the original proverb (OP), (b) surface transformation of

the OP (a literal paraphrase of the OP), (d) both synonym and surface trans-

formation, (e) a proverb with the same literal meaning as the OP but a dif-

ferent figural meaning, (f) a control proverb with both figural and literal

differences from the OP. Twenty different proverb sets of this form were

developed. The manipulation was composed of two treatments. Subjects were

presented with one of the several proverb lists and given a two alternative

forced choice recognition test. Another group of subjects received a similar

proverb list but took a figural comprehension test after each presentation

(again a two alternative forced choice test). These subjects then received a recognition test like subjects in the first group. The results of the experiment suggested three main outcomes. First, improved comprehension of the figural meaning at acquisition (deep comprehension condition) led to increased recognition of figural meaning on the criterion test. Second, at the time of the recognition test (5 minutes after lists were presented) subjects showed good memory for the original syntactic structure, lexical information, literal meanings and figural meanings. Bock and Brewer suggest that this illustrates the weakness of models such as HAM (Anderson and Bower, 1973) which treat only one level of processing. Third, contrary to other research (Sachs, 1967), subjects in this study demonstrated extremely good memory for items at all levels of processing, including surface structure. It could be, however, that the two-choice testing procedure created this latter result. This study seems to illuminate some interesting possibilities for research with metaphor. Since good memory is exhibited for both literal and figurative meanings a reconstructive approach to metaphor might be feasible. That is, the figurative meaning of some metaphorical communication could be constructed at recall as well as at acquisition. The results suggest that if procedures are used which require the comprehension of a figurative level of meaning, memory for the figural meaning will be quite good. It should be noted, however, that in Bock and Brewer's deep comprehension task subjects actually received two exposures to the correct figurative interpretation. This might account for the high figural recognitions scores just as well as the deeper processing hypothesis does.

Both Osborn and Ehninger (cited in Reinsch, 1971) examined the functions of metaphor in rhetorical discourse. On the basis of an informal, subjective, evaluation they concluded that the metaphorical process was characterized by

three mental events; error, puzzlement-recoil, and resolution. Error was
thought to encompass the hearer's initial unsuccessful attempt to under-
stand the metaphoric statment literally. Puzzlement-recoil describes the
cognitive difficulty (dissonance?) which follows error and leads to the re-
jection of the literal interpretation. Resolution suggests the mental
discovery of similarities between the topic and the vehicle of the metaphor.
The Osborn and Ehninger paradigm seems to suggest rather naturally the re-
search tract recently taken by Brewer, Harris and Brewer (1976).

Using proverbs again, Brewer et al., postulated that unfamiliar proverbs
are understood in two sequentially ordered steps. The notion is that on
encounte a proverb one first attempts to comprehend the literal meaning,
then only after that is accomplished, is the figural meaning processed.
Fifty-six proverb sets each containing five components were constructed.
These components were: (a) the original proverb, OP, (b) a literal-same-
paraphrase of the OP which maintained the literal meaning, (c) a literal-
different paraphra (d) a figurative-same paraphrase, (e) a figurative-
different paraphrase. The subjects were instructed to read and understand
two sentences (selected from the above options) and to determine if they had
the same or different meanings. Experimental pairs were constructed by
randomly combining OP's and their paraphrases. Half the time the OP was
presented first and half the time, second. It was found that it took sub-
jects longer to understand the figural meaning when the OP was presented
second, but not when it was presented first. This interaction was expected
because when the OP was presented first both figural and literal meanings
were available to the subject. When the OP was presented second, the
figural meaning had to be comprehend rom the literal meaning. These

38

results seem to support the hypothesis that comprehension of the literal level of meaning proceeds the comprehension of the figural level. Brewer et al., conclude that, since both metaphors and proverbs have figural and literal components this finding should generalize to the more global case of metaphor.

Conclusion. Research into the comprehension on non-literal uses of language done with adults has yielded only slightly more information than that done with children. The Verbrugge and McCarrell experiments do seem to reveal an interesting quality of metaphor. The fact that the inferred ground of a metaphorical relationship acts as a good recall cue seems to indicate that some sort of special mental processing or cognitive work is done when a metaphor is presented. The nature or depth of this processing, however, is not revealed. The research of Brewer and his associates would indicate that processing non-literal uses of language does involve processing the literal meaning first. This is not altogether surprising when one considers that the literal meaning obviously contributes to the anticipated non-literal interpretation.

If there is a problem with the adult research it is primarily that it fails to investigate a number of important questions. What is the relationship between the literal and non-literal meaning? To what extent does context facilitate the comprehension of metaphors. What communicative benefits do they bring? There are other questions too, which need to be investigated. The box has been opened, but the contents are yet to be examined.

39

Some Recommendations for Future Research

Traditionally, the study of metaphor has been predominately undertaken by scholars of philosophy and literature; it has been slow to find its way into the domain of psychology and education. Yet, an understanding of metaphor and the comminicative functions it serves is not only an interesting problem area in psycholinguistics, but also has important implications in education. We therefore now address the question of the relevance of the study of metaphor in psychology and education.

The importance of studying metaphor. Cognitive psycho` ·, ··, during the last few years, seen a surge of interest in models of semantic memory and language comprehension, yet few of the theorists who have worked in this area have considered metaphor to be sufficiently important to warrant their atten-tion. Kintsch (1972,1974) and to some extent Collins and Quillian (1972) might be regarded as exceptions to this claim, but still, while acknowledging the problem, they have little to say about it. Rumelhart and Ortony (1977) also discuss the way in which their knowledge representational "schemata" might facilitate the comprehension of metaphor, but again their discussion is rather peripheral to their main concerns. We have suggested that metaphor is not some freak occurrence disturbing the otherwise smooth flow of ordinary literal language use. Metaphor, particularly when considered along with other non-literal uses of language, is a very pervasive phenomenon. Any psycho-linguistic theory which does not handle metaphor is thus incomplete, and any which cannot handle it is inadequate. Of course, it must be recognized that an account of the way in which people comprehend non-literal uses of language is a fairly heavy demand to place upon a theory of language comprehension (indeed, it might be objected that it is an unfairly heavy demand!), but it

seems to be a crucial test. It is probably the case that different theo-
retical notions lead to different predictions about the comprehension of
metaphor, although it would be necessary to extend current theoretical posi-
tions beyond existing statements of them to make any kind of prediction at all.

In terms of the robustness of the models that psychologists have proposed
for the way in which people understand language and the way in which they store
the results of that understanding, metaphor could pose some quite serious
problems. For example propositional models, which are characterized by the
representation of all knowledge and comprehended sentences as propositions
(e.g. Anderson and Bower, 1973; Kintsch, 1974), seem to be forced to treat
metaphors as semantic anomalies. In fact Kintsch goes to far as to suggest
that semantic anomaly is a necessary condition for something's being a metaphor.
Inevitably, this leads to an impasse: how to distinguish metaphor from
"genuine" semantic unacceptability. Such theories seem to be hampered by their
reliance on too rigid a notion of word meaning (see, for example, Anderson and
Ortony, 1975) and this constraint is likely to lead to an overhasty characteriza-
tion of input sentences as being semantically anomolous. The representation
of word meanings in such models simply fails to permit the kind of flexibility
that would be required to make sense of a metaphor. In any event, models of
this type, were they to attempt to make sense of metaphors, appear to require a
two stage process. The first stage would involve an attempt to impose a literal
meaning on the input sentence, which, presumably, would fail. The second stage
would involve an attempt to "recover" from the "error." The only psychological
account of this process that has been offered is that of Kintsch who proposes

41

that the anomalous input string be coverted into an explicit comparison.
This proposal has some merits, but it again runs into the problem of dis-
tinguishing genuine metaphors from mere nonsense or falsehoods.

An alternative representational arrangement is that advocated by schema
theorists (see, Minsky, 1975; Schank, 1975; Rumelhart and Ortony, 1977). At
least in some versions of this approach, knowledge is represented in a rather
more flexible manner than in propositional models. Whereas in propositional
models word meanings are represented as propositions about the "core" meaning,
in schema theory what gets represented is knowledge associated with the things
to which words refer. Thus, what a schema contains is not so much information
about what is necessarily the case, but information about what is usually or
normally the case. For example, in a propositional model the meaning of a
word like "cow" is pretty much exhausted, in the best Aristotelian tradition,
by a statement of its species and differentia. Thus, a cow is a mature female
of cattle. By contrast, the schema for "cow" would include a great deal of
information people have about cows; that they are domesticated, provide milk
etc. The structure of a schema is of a series of variables together with
relationships between them. Whereas there are constraints on the values that
the variables may take, these constraints are rarely absolute, although some
values are more typical than others. This kind of representational system
appears to offer greater flexibility for matching incoming information to
previously stored knowledge, and with this flexibility comes a better prospect
for dealing with non-literal uses of language. The effect of a metaphor would
be to change the shape of the range of values that variables within a schema
can and do take on. The metaphorical interpretation would be achieved by
finding that schema or those schemata which matched the input changes in
variable ranges was the least.

Propositional models and schema-based models might handle the comprehen-
sion of metaphors in rather different ways: the first requiring some kind
of special processing, the second, perhaps not. There is another class of
theory which might make yet different predictions. The theories in question
are not really incompatible with either of the above types. We refer to the
so-called network theories (e.g., Quillian, 1968; Collins and Quillian, 1969,
1972; and Collins and Loftus, 1975). Network theories can be regarded as being
more process-oriented than structure-oriented. They say little about the
internal structure of the concepts which constitute the nodes of a semantic
network, preferring to concentrate on the consequences of a spreading activa-
tion mechanism for "moving about" within that network. Thus, a network theory
is compatible with, for example, a schema theory, since the nodes could repre-
sent schemata. In any event, network theories or at least the spreading activa-
tion processing aspect of them, could make yet different predictions about the
processing of metaphors. The basis of the spreading activation process is the
notion of an "intersection," namely, a concept which is associatively connected
and, consequently, activated, from two or more of the concepts in the input
string. The intersection has to be semantically "close" to the originating
nodes so as to prevent the situation in which every node in the network counts
as an intersection for an arbitrary pair of originating nodes. Such a mech-
anism seems rather well suited to handling metaphor. This is because it
would permit the ground of the metaphor to be determined by the intersection
or intersections arising from activation spreading from the topic and the
vehicle. The incompatible aspects of the two, namely those aspects of the
topic and vehicle which jointly gave rise to the tension, would be much less
likely to result in an intersection. Thus, spreading activation seems to offer
the prospect of a fairly automatic way of determining the ground of a metaphor
without invoking all the irrelevant aspects of it. It may be that these

43

observations amount to little more than that the vaguer the theory, the more
likely is it to be able (in principle) to handle metaphors. This is probably
true. Nevertheless, it is difficult not to speculate as to how various theor-
etical orientations might deal with the problem.

How these various theories are to deal with metaphor must depend on the
facts; facts which have yet to be determined. We need to know much more than
we do now about what happens when people process figurative language. We need
to know whether metaphors take more time to process, we need to know how con-
text interacts with processing time. Is the processing of "dead" metaphors
and of idioms different from the processing of creative, novel metaphors?
There are many other questions. But to adequately investigate such issues re-
quires a more powerful experimental paradigm than is currently available. For
one thing, it requires a paradigm that permits the comparison of metaphorical
with literal uses. Such a paradigm has been developed by the first two
authors and their collaborators and will be outlined in the next section.

If the study of metaphor is important in cognitive psychology, it is no
less important in education. The most trivial reason for this is that educa-
tion is largely concerned with the acquisition of knowledge through the medium
of language. If metaphor is a ubiquitous linguistic phenomenon, then knowing
how metaphors are processed, and what constraints exist on their comprehension,
is part of understanding the learning process. However, there are more profound
ways in which metaphor is of concern in education, reasons concerned with peda-
gogy and radical conceptual change. In discussing the role of metaphor in
education, it is necessary to broaden our notion of metaphor somewhat. For al-
though metaphors occur in instructional materials and in instructional dialogue
at the level of individual sentences, the really crucial role they play is in
systems. We might call them extended metaphors, or analogies, or even models.

It is common knowledge that it is easier to understand new things if they are cast in terms of old. In the field of developmental psycholinguistics this fact has been expressed by Slobin (1971) in terms of the principle: "New forms first express old functions, and new functions are first expressed by old forms." Apart from the fact that this principle in itself is consistent with the generation of metaphors by children, it seems to be a general principle of learning. It follows that the manifestation of the principle will occur through a process which in some way compares, explicitly or implicitly, the old function served by the old form and the new function served by it. One of the ways in which such comparative relationships can be drawn out is by the use of metaphors, similes, analogies and models.

It would be a mistake to restrict one's concern with the role of metaphors in learning to the learning of subject matter. There are more global, educational processes in which metaphor plays an important role. Petrie (1976) discusses these issues when he talks about problems of interdisciplinary work, particularly in the context of the problems posed by the fact that different disciplinary orientations gave rise to different ways of perceiving the same phenomena. Petrie claims that the reason for this is that different disciplines presuppose different "cognitive maps," by which he means "the whole paradigmatic and perceptual apparatus used by any given discipline. This includes, but is not limited to, basic concepts, modes of inquiry, problem definition, observational categories, representation techniques, standards of proof, types of explanation, and general ideas of what constitutes a discipline" (p. 11). He argues persuasively that the key pedagogical tool for bridging disciplinary gaps is metaphor, conceived of in the same broad way in which we do here.

We are of the opinion that good research could contribute to a better understanding of the nature and role of metaphor in human thought. Our view has suggested that little good research has been done and that at least one of the reasons for this is that there is not available at the moment a theoretical account of the nature of metaphor which can be frutifully employed in psychological and educational research. If this review is to make a positive contribution, we hope it will do so by pointing to a possible way of alleviating this deficiency.

An approach to the study of metaphor. The cognitive psychologist is concerned with when and why people use metaphors, when and how they understand them, and how the processes presumed to underlie their use and comprehension differ from and are related to those processes involved in the comprehension of literal uses of language.

The solution to these problems do not lie in diagnosing, or attempting to diagnose, peculiarities, such as semantic anonaly, in the surface structure of an utterance. It is for this reason that Kintsch (1974) fails to find an adequate solution. It simply is not the case that all metaphors are semantically anomalous, consequently, semantic anomaly cannot possibly be a necessary condition for something's being a metaphor.

The most compelling fact which Kintsch and many others have ignored is that many metaphors are semantically perfectly well formed sentences. Consider, for example, our final sentence of the last complete section (p. 36), or:

(1) Regardless of the danger, the troops marched on.

It is a perfectly normal English sentence, and is certainly not semantically anomalous. What determines whether it is a metaphor or not is the context in which it is used. In the context of an army marching to battle it is likely

to require a literal interpretation. But in other contexts it is not. For
example, consider its role in (2):

(2) The children had been annoying their teacher all morning,
and she was becoming increasingly irritated by their unruly
behavior. She simply did not know how to stop them climbing
on the chairs and tables and throwing all manner of objects
about the room. She decided to threaten to punish every one
of them if they did not stop. As loud as she could, she
shouted her warning. She would make them all stand outside
in the rain. Regardless of the danger, the troops marched
on.

In the context of the school teacher and her problem, the entire sentence

(1) is a metaphor. It is not really a case of a word of phrase being applied

to an object it does not literally denote, for none of the substantive words

literally denote their usual objects or concepts. Standing in the rain is

hardly a danger, there are no real troops and there is no real marching.

But surely one cannot argue, as Kintsch wants to, that because (1) is not

semantically anomalous it is not a metaphor. The importance of the fact that

metaphors need not be semantically anomalous has not been totally overlooked.

It is implicit in Perrine's (1971) four categories of metaphor. In his fourth

category, Perrine argues that both the topic and the vehicle are implicit.

Perrine does not explicitly discuss the role of semantic anomaly in metaphor.

On the other hand both Reddy (1969) and Van Dijk (1975) emphasize the fact

that it is not necessary for metaphors to be semantically anomalous.

Reverting to our example, what makes (1) a metaphor is not that it is

semantically anomalous, but that it is pragmatically, or contextually anomalous.

The metaphorical meaning of, say, (1), is related to certain implications of

its literal meaning, for whatever the literal meaning of (1) is, its meta-

phorical meaning in the context (2) will be those contextually relevant salient

components of its literal meaning which do not conflict with the context.

For example, one implication of the literal meaning of (1) is that a group

of people continued doing what they were already doing without concern for

the consequences. Another is that these consequences were undesirable, and

another that the people were aware of this, but stubbornly unconcerned, and

so on.

The selection of salient aspects of the literal meaning of a metaphor

which are not incompatible with the context is referred to as a process of

tension elimination in Ortony (1975). In the case of a metaphor such as (1)

in (2), the tension is caused by the incompatibility of the literal inter-

pretation of (1) and the context in which it occurs. The notion of meta-

phorical tension is just as applicable to semantically well-formed sentences

like (1) as it is to semantically anomalous sentences such as (3) which

constituted the prototypical metaphor for early research.

(3) The ship plowed the seas.

In both cases, (1) and (3), comprehension seems to require the elimination

of aspects of the meaning of expressions that when interpreted literally give

rise to tension.

Perhaps we should now try to reformulate a definition of metaphor. A

first condition for something's being a metaphor appears to be that it is

contextually, or pragmatically anomalous. This means that if it is inter-

preted literally, it fails to fit the context. This allows (1) to be a meta-

phor in the context of (2), while excluding it in those cases where it is

literally interpretable. Consequently what is a metaphor is not a sentence,

but a token of a sentence or an utterance. The contextual anomaly condition

also allows us to include (3) since it will fail to fit with almost all

conceivable contexts. Now while the pragmatic anomaly condition is a neces-
ary condition, it is not a sufficient condition for it fails to exclude cases
such as (4) which are unresolvable semantic anomalies:

(4) Regardless of the wavelength, some anger programmed the

bus sandwich.

It might be argued that in some possible context (4) could be used as a
metaphor, or even literally, and if this is indeed true then one would not
want to exclude it. But, for the sake of argument let us suppose that (4)
is unresolvable as a semantic anomaly. This suggests a second condition,
namely, that for something to be a metaphor it must be possible, in principle,
to eliminate the tension. It seems, then, that we have two conditions which,
taken together, are necessary and sufficient for a linguistic expression to
be a metaphor. The expression should be contextually anomalous, and the
metaphorical tension must be in principle eliminable. These conditions ought
probably to be elaborated in terms of the speaker's intentions. One might
for example claim that for a speaker to intend to utter something methaphori-
cally he must believe that both conditions hold. If he doesn't, he still
might produce a metaphor but by accident. It would be an accident in the
sense that a hearer may wrongly attribute to the speaker certain intentions
which he never had, consequently communication may break down.

The two important components of metaphor in this view become the con-
textual or pragmatic anomaly aspect, and the tension elimination aspect.
The former can be handled at the theoretical level by invoking a Gricean
analysis of the violation or apparent violation of conversational rules
subsumed under the cooperative principle (see Grice, 1975). The latter has
been discussed in Ortony (1975).

49

With this view of metaphor it is possible to conduct empirical research

that provides adequate controls. One can investigate the comprehension of

metaphors using a variety of dependent measures while controlling for surface

structure characteristics. This can be done by comparing performance using

a target item when its preceding context induces a literal interpretation to

the same target when the context induces a metaphorical interpretation. One

can also control for meaning since it is much easier to generate a literal

paraphrase of a whole-sentence metaphor than it is of a part-sentence metaphor

(compare the ease of generating a literal equivalent of (1) as opposed to (3).

Whether or not whole-sentence metaphors are easier or more difficult to

understand than part-sentence metaphors is a question which cannot yet be

answered. But our feeling is that much more can be learned using whole-sentence

paradigms and that that is the place to start.

As our review has shown, many theorists believe that metaphors are

(intended to suggest) comparisons. The account that we have given suggests

that the role of comparison is in the tension elimination process itself.

Undoubtedly some metaphors are intended by their authors to focus on compara-

tive aspects, but others may be vehicles for understanding things in new ways,

or for expressing what is literally inexpressible. In such cases comparison

may be better regarded as the means of comprehension rather than the purpose

of it. In any event, invoking comparison to explain metaphor has its own

problems. For one must distinguish between literal comparisons and non-literal

comparisons and that problem is as difficult as any.

Conclusion

We have seen that research into the comprehension of metaphor leaves something to be desired, and we have suggested that an inadequate definition or theory of metaphor is to some extent to blame for this. In an effort to contribute to the solution of this difficulty we have suggested an approach to research into the comprehension of metaphor, and along with that, we suggested a general purpose definition. Before finishing, a few additional remarks are necessary to place our definition of metaphor in perspective.

It will be recalled that two major approaches to the theory of metaphor were discussed -- the comparison theory, and the interactionist theory. In addition reference was made to the substitution theory. We took the position that the comparison theory was inadequate if interpreted as meaning that all metaphors are (intended as) comparisons. Furthermore it was suggested that since some comparisons can only be conceived of as non-literal, the comparison view fails to explain the non-literal aspects of metaphor. Consider the following metaphor:

(5) Abdul-Jabbar is professional basketball's Sears building.

Here it is assumed that Abdul-Jabbar is the tallest player in professional basetball, and presumable this is what someone uttering a token of (5) would be meaning to assert. But if this comparison is taken to be the implicit "meaning" of (5) then it is presumably equivalent in meaning to the simile (6):

(6) Abdul-Jabbar (the professional basketball player) is like the
     Sears building.

The point that needs to be emphasized is that (6) is not a literally true comparison, for the topic and vehicle are more dissimilar than they are similar. A literal comparison might be something like (7) where the topic and vehicle really are similar.

(7)   The Hancock building is like the Sears building.

Now it is of course true that the extent to which these comparisons are

appropriate (and are true) depends on the context in which they are used, but

taken literally (6) is still a non-literal comparison when compared with (7).

The point of this discussion is to emphasize that in cases where meta-

phors really are comparisons, the comparisons themselves need to be accounted

for in terms of a theory of non-literal uses of language, since those compari-

sons will often by non-literal ones.

Perrine (1971) is one of the few theorists to have proposed a viable

classification of metaphors. As discussed earlier, his fourfold classifica-

tion is based on the explicit or implicit occurrence of a metaphor's topic

and vehicle. We suggested in discussing the "eureka" aspect of the inter-

actionist view that it was perhaps related to a comprehender's discovery of

the implicit components of the metaphor. Our definition of metaphor as tension

resolvable contextual anomaly is consistent with Perrine's classification in

that the implicit elements have to be determined largely by the context. In

those cases of metaphor where the topic and vehicle are explicitly stated,

the contextual anomaly results solely from the fact that a literal interpre-

tation is false or nonsensical, and this is true for explicitly non-literal

comparisons, i.e., similes, as well. In this way, we see our definition

as providing a basis for distinguishing metaphors from literal uses of lan-

guage, in such a way that a taxonomy of different types is compatible with it.

The paradigm we have suggested for pursuing research in the area seems

suited to inviestigating metaphors in Perrine's fourth category where both

topic and vehicle are implicit It also seems applicable to his second cate-

gory wherein the topic is implicit and the vehicle is explicit. Perrine's first

category is probably better handled by investigating the similes derivable

from the metaphors.   Only the third category remains.   It might be better
to leave their study until the more tractable types have been studied.

The psychological study of metaphor is about to ripen.   Its fruits
promise to be useful both theoretically, in psycholinguistics, and prac-
tically, in education.   It is to be hoped that this review can contribute
to the ripening of that study.

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